# Jet Propulsion Laboratory

## ATMOSPHERIC INFRARED SOUNDER (AIRS)

## DPIO STATUS AND PLANS

Science Team Meeting

Denis Elliott

October 22, 1997

**JPL**

**AIRS**

# OUTLINE

- Prototype 6 Status

  - Functionality improvements

  - Timing measurements

- Configuration Management Changes

- Prototype 7 Plan

- Instrument Operations

  - AIRS flight software

  - Spacecraft software

  - Flight Operations Software—AIRS version

**JPL**

# PROTOTYPE 6

- To be completed next week

- Significant changes from Prototype 5

  - Some changes for compatibility with DAAC environment have been made

    - Will use a Process Control File for locating input data files

    - Will open input files using toolkit routines

  - Level 1B improvements

    - Calibration smoothing works correctly in the presence of data granule boundaries

    - Smoothed calibration parameters are interpolated in time at every footprint

    - DC Restore discontinuities characterized and corrected

# PROTOTYPE 6 (CONT.)

– Level 2

➢ 100-level IR RTA used for both simulation and retrievals

➢ Microwave simulation and retrievals now use consistent RTA

➢ Interactions with science team members and their staff have led to improvements in quality of retrievals

◗ Problem in thin layers near surface in simulated data fixed

◗ Some bug fixes in final retrieval code

JPL

AIRS

# TIMING

**Level 2 Timing Comparisons**

**JPL**

**AIRS**
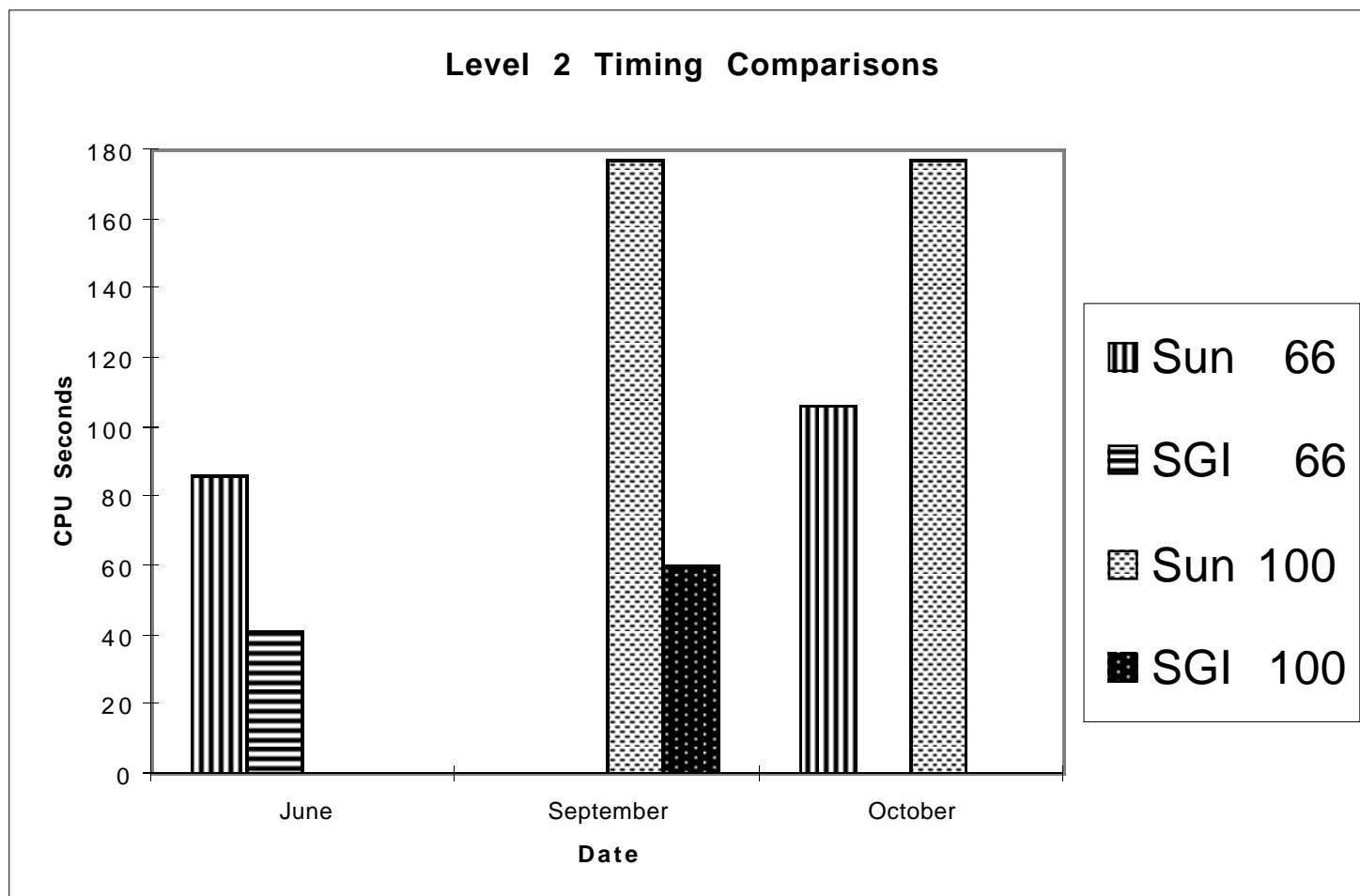
# CONFIGURATION MANAGEMENT

- New system (CCC Harvest) has been installed

- CM Procedures for DPIO have been documented and will be distributed by the end of this week
  - Much will not be applicable to science team
  - Need to look closely only at check in and check out processes

- Hands-on training for JPL staff next week—session will be video-taped and tapes will be available on request

- We at JPL will switch to actual use of CCC Harvest at the start of Prototype 7 development November 3

- Hands-on training for science team programmers can happen (if needed) at time of next team meeting on the west coast (February 1998)

**JPL**

**AIRS**

# CONFIGURATION MANAGEMENT (CONT.)

- Because science team users of the system only do simple checking in and checking out of code, hands-on training should not be necessary

- "Getting Started" instructions for science team members will be sent out in late November

- JPL contact for CM questions is Vicky Myers at (818) 354-7286. Bob Oliphant at (818) 393-2822 will also be available for help

# PROTOTYPE 7 = BETA DELIVERY

- EOSDIS Review Group and PM Project are studying possibility of using DAAC only for archival and distribution. Product generation might be done under direct control of instrument teams at facilities local to them.

- However, the official plan still calls for AIRS products to be produced at the GSFC DAAC and we continue to operate under that assumption

- Prototype 7 will become our Beta delivery, to be ready by June 1998

**JPL**

**AIRS**

# PLANNED UPGRADES FROM P6

- DAAC Compatibility

  - Correct use of Process Control File throughout

  - All input/output done using toolkit

  - Remove all prohibited functions

  - Generate required metadata

  - Source code module prologues compliant with EOSDIS standards

  - Run on an SGI computer

    - P6 runs on both Sun and SGI with identical source code

- Parallel processing

  - DAAC will not support parallel processing in Beta delivery time frame

  - Plan a stand-alone demonstration of Level 2 in parallel mode to get measurements of performance gains

**JPL**

**AIRS**

# PLANNED UPGRADES (CONT.)

- New file structure to reduce number of output files

  - Use HDF swath format

  - Optimization of granule boundary crossing design (for calibration smoothing windows)

  - Define special calibration mode file structure

- Level 1A

  - Updated decommutation maps for all instruments, including their engineering data

  - Instrument data synchronization for scan set construction

  - Recognize and handle special calibrations

**JPL**

**AIRS**

# PLANNED UPGRADES (CONT.)

- Level 1B

  – Finish AIRS radiometric calibration design for nominal data

  – AIRS spectral calibration

  – Obtain NOAA's radiometric calibration software for AMSU-A and AMSU-B
  and modify our microwave Level 1B code accordingly

  – Finish implementation of granule-boundary-crossing code for nominal data

  – Browse summary file generation

- Level 2

  – Team algorithm updates

JPL            AIRS

# V1 AN V2 DELIVERIES

- Continued evolution of retrieval algorithms
- Population of tables of instrument parameters from flight model ground testing
- Additional functionality
  - Collection (for validation and algorithm maintenance) of co-located radiosondes with AIRS/AMSU-A/HSB radiance data and Level 2 products
  - error estimates
  - quality flags
  - metadata (beyond the minimum required for Beta)
  - Tuning (calculation and application of coefficients)
  - Browse products
- Performance (including parallel processing)
- Robustness
  - Retrieval-stressing atmospheric conditions
  - data outages
  - instrument problems

JPL

AIRS

# INSTRUMENT OPERABILITY

- DPIO has two sides
  - Science-related software
    - ➢ Product generation software
    - ➢ Product validation and analysis software
  - Instrument operations support
    - ➢ Provide instrument databases for the EOSDIS Operations Center (EOC)
      - ◗ commanding support
      - ◗ engineering data display and monitoring
    - ➢ Instrument engineering analysis support
      - ◗ Troubleshooting
      - ◗ Trend analysis
    - ➢ AIRS flight software maintenance
    - ➢ Spacecraft software interface understanding and definition
- The rest of this presentation will describe what is going on in the operations side of DPIO

# AIRS FLIGHT SOFTWARE

- Code to implement all original requirements has been completed and is in use during EM testing

- Some revisions to the software are in process to handle some new requirements added as the instrument electronics design matured

- Some additional revisions have been requested by DPIO to provide additional support for instrument operations

  - Various tables which control hardware have default values residing in ROM

  - Two tables (scan profile and engineering data collection) also have space for alternate versions reserved in RAM

  - Software functions exist to switch between table versions and convert an alternate table to operational state

# AIRS FLIGHT SOFTWARE (CONT.)

– We requested that four more tables be added to the list for which alternates are supported

➢ Detector gain/circumvention level

➢ Subsample integration time

➢ Subsample weights

➢ PV detector bias voltages

– The purpose is to permit rapid switching of these tables during special calibration sequences

# SPACECRAFT SOFTWARE

- Spacecraft is doing four things for us:

  - Ensuring that AIRS command packets are not sent to the instrument faster than 1 packet every 375 milliseconds (command metering)

  - Monitoring a subset of the engineering telemetry for out-of-limit conditions

  - Providing space for stored command sequences

    - Can be started by a single ground command

    - Can be started automatically in response to instrument conditions discovered during monitoring of engineering telemetry

  - Supporting our special calibration sequences

    - Additional table storage

    - Software to send the tables to the instrument upon command, in the correct format and at the correct rate

# SPACECRAFT SOFTWARE (CONT.)

- During the past year we have worked out the requirements and some of the interface details with TRW for the special calibration support and for the telemetry monitoring

- Recent activity has concentrated on command metering

  - This is a complex issue because of buffering requirements and memory limitations on the spacecraft computers

  - Work is still in progress

- An open area which still requires considerable work is stored command sequences—the problem is that the EOSDIS Flight Operations Software (FOS) does not presently support these sequences in a convenient manner

**JPL**   **AIRS**

# FOS SOFTWARE BACKGROUND

- Flight Operations Segment is one of the key components of the EOSDIS

- The software which supports mission operations within the FOS is called the FOS software

- Developed by Lockheed Martin Space Mission Systems and Services (LMSMSS) as part of the Hughes consortium responsible for the EOSDIS Core System implementation

- Two releases which support the AM mission have been completed and additional releases are planned

- TRW has contracted with LMSMSS for a customized version of FOS to support PM spacecraft I&T

- PM Project is expected to use FOS for its operations, but they are not yet on contract with LMSMSS

# AIRS USE OF FOS SOFTWARE

- DPIO must provide **validated** command sequences for AIRS to TRW for use during spacecraft I&T

- DPIO must populate databases in the TRW version of the FOS software to control engineering telemetry display and monitoring

- DPIO must provide similar (but more complete) instrument databases in FOS software format for use in a PM version at the EOC after launch

- In order to fulfill our requirements, we need to start building the databases now. Our only chance to validate command sequences is during ground testing of AIRS at LMIRIS

**JPL**                                                                                    **AIRS**

# FOS SOFTWARE—AIRS VERSION

- We have contracted with LMSMSS for an AIRS version of the FOS software

- The database structure, user interface, and software design of all FOS versions are the same—versions differ only because of some differing added functionality

- Our contract has three phases
  - Delivery of a copy of the TRW version, as it stands in October 1997, to us in November
  - Connectivity and communications between the FOS software and the AIRS ground support system for use during command sequence validation at LMIRIS—due January 1998
  - Specialized support for AIRS commands and telemetry which is not in the AM version but which must eventually become part of the PM version—April 1998
    - ➢ Multiple commands per packet
    - ➢ Flexible packets